

# How Life Events Are Integrated into the Self as Memories: A Memory Approach to Need Satisfaction and Emotion Regulation

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## Abstract

This chapter proposes a memory approach to the question of integration in self-determination theory. It suggests that life events are critical to the integrative process, as they represent the success or failure of humans' interactions with the environment. Their encoding as memories and their cognitive organizations help to reduce uncertainty by providing humans with the capacity to predict what will occur in similar future situations. Three qualities relative to the integration of life events are presented along with empirical evidence supporting them: (1) the encoding and reconstruction of life events in memory as need satisfying, (2) their incorporation as event memories in need-satisfying memory networks, and (3) their integration in higher-level representations, notably through emotion regulation processes. Overall, it is shown that the organismic concept of integration from self-determination theory is in line with other neurocognitive theories on memory and the functioning of the brain. The combination of memory theories with self-determination theory appears as a fruitful research avenue to the study of the integrative process.

**Key Words:** integrative process, memory, life event, need satisfaction, emotion regulation

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A fundamental organismic perspective characterizes the notion of integration in self-determination theory (SDT). This perspective is derived from biology and specifies that all living organisms—in contrast to non-living entities—tend toward negentropy and are therefore constantly oriented toward growth, synthesis, organization, and unity (Ryan & Deci, 2002; Ryan et al., 2019). This negentropy implies that living organisms are made up of, or constituted by, lower order functional unities embedded within higher order ones, and the whole functioning of this system is the unity (Ryan, Kuhl, & Deci, 1997). However, this integrated brain architecture of lower and higher units has not been greatly investigated within SDT. There was a very early interest in SDT in gathering initial evidence of certain brain regions identified as potentially responsible of integrative processes (Ryan et al., 1997), and more recently, the mental processes facilitating this integration

were described (Weinstein et al., 2013) and great advances have been made to unveil brain activity occurring during integrative processing (e.g., Di Domenico et al., 2016; Reeve & Lee, 2019). However, it is still imprecise what exactly this integration and its processes produce in terms of stable and coherent lower and higher levels of cognitive structures in the brain so that a sense of integrity can be subjectively experienced and can lead to (or predict) the consequences of vitality and well-being frequently observed in empirical research.

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In this chapter, I present a memory approach onto the question of integration which I believe help to shed light on the distinct qualities of an integrated mental organization (Weinstein et al., 2013) and how such an organization can lead to the consequences of integration observed in empirical research (e.g., Hodgins & Knee, 2002; Houle & Philippe, 2020; Weinstein et al., 2011). A memory approach to the question of integration is particularly concerned with how past experiences are encoded and stored, the cognitive structures implicated, their processes, functions, and interactive patterns, all to understand how they can produce future experiences and behaviors. A memory approach is also amenable to understand and empirically investigate the combination of lower and higher order units, characteristic of the organismic perspective of SDT, to explain humans' whole functioning. Such an approach should also be translatable into brain and cell functions, thereby bridging distinct levels of information and observation to help developing a full neurocognitive socio-behavioral approach to motivation and personality. Finally, bringing a different spotlight to the question of integration also has the merit of providing new ways of testing the theory and may also yield novel empirical measures that can supplement existing ones.

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### **Why is integration important?**

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The purpose of any living organism can be understood as fighting entropy (or being negentropic), that is, as minimally avoiding chaos and as being able to make precise predictions about its living environment (Friston, 2010; Hirsh et al., 2012). Entropy, as defined by the second law of thermodynamics, is the law that all isolated or closed system constantly tends toward randomness. It predicts that your bedroom will get more and more messy and dirty as time passes—in other words, entropy will increase. When you clean your bedroom, you fight entropy and temporarily reduce it. But your bedroom will always tend toward messiness. As humans, we live in an ever-changing environment and we learn to reduce entropy by making predictions about the external world and test their adequacy (Friston, 2010). Doing so, we learn which predictions are fairly adequate and which ones should be modified or plainly wrong. We therefore learn how to reduce uncertainty—we integrate the actions that are effective at reducing this uncertainty, and we also learn which ones are not effective and should be avoided. As such, we build self-knowledge (what works for us) and knowledge about the external world (what works in the world). Importantly, this active interaction and exchange with the external environment

is a constant activity (Ryan & Deci, 2017), potentially occurring in a Bayesian process (Knill & Pouget, 2004), that regularly updates itself and continually develops its internal organization and extends it toward greater unity.

C13P4 The only way organisms have to access their environment and reduce uncertainty about it is through their perceptions and senses (Friston, 2010). Sensory data is therefore critical to understand whether events occurring are something that should be approached or avoided and how. This sensory data is processed according to the living organism's genotype and phenotype that has developed over its evolutionary history as indicators of what information from the internal and external environments provide value states to the organism (Niven & Laughlin, 2008). In humans, satisfaction of the three basic psychological needs correspond to a small number of innate value states orienting individuals in their exploration of the world toward what to seek and what to avoid. Satisfaction or frustration of autonomy, competence, and relatedness, following an interaction with the environment or what is called a life event, provides critical information to consider when learning whether such an event should be approached or avoided in the future. Satisfaction of these needs therefore reduces entropy and increases one's certainty about which actions to undertake to successfully interact with the environment in a given context.

### C13S2 **Interacting with the environment: Why are life events important?**

C13P5 Life events are critical in the developmental process of humans. They are the output of the interaction between a person (and his phenotype) and the environment. As such, life events are indicators of the success or failure of our interactions with the environment. They represent important learning about how to behave in that environment and this learning needs to be encoded, but also organized with other learned experiences. As such, life events create *priors* in the form of mental representations that can later be used to determine the most optimal way to act in a future similar event. Such priors encode the sensory input related to the contextual detail of the event with a specific action, sequence of actions to undertake, or meaning, called *policy*. These action and meaning policies motivate and orient short- and long-term actions (i.e., goals) and create expectations or beliefs regarding the probability of success of these actions and goals in the future.

### C13S3 **How are life events integrated?**

C13P6 In the present chapter, I will describe three qualities relative to the integration of a life event: A) To be encoded and reconstructed in memory as need satisfying, B) to be incorporated as an event memory in a need-satisfying memory network, and C) to be integrated in higher-level representations.

C13P7 Life events are initially encoded as *episodic memories*, which consist of the sensory components of a past event, including imagery and other sensory-motor information such as a smell or a physiological arousal, and a cognitive-affective experiential component of what has been experienced during the event (Conway, 2009). When this sensory-motor

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Prior	Internalized mental representation determining whether a situation should be approached or avoided and what action policy to undertake as a function of the contextual detail of that situation.
Policy	An action or sequences of action or meaning to ascribe to a situation likely to bring the desired outcome in a specific situation.
Episodic memory	The sensory-motor information related to a life event, including the cognitive-affective experiential component of what has been experienced during the event.
Autobiographical memory	The narrative form of an episodic memory, combining the details of the episodic memory with the generic knowledge of semantic memory.
Memory network	All the memories, main or target memory and networked memories, that are activated within a given situation.
Networked memories	The memories associated with a main or target memory

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information is reconstructed within a narrated story that occurred at a specific time and place and in a specific order, it becomes an *autobiographical memory* (Cabeza & St Jacques, 2007). This is a more abstracted form of the episodic memory. When several similar autobiographical memories are combined, they become general event memories (e.g., all the lessons I taught at university vs. when a student threw up in the classroom, which would be a specific memory), which can be rearranged to form higher-level abstractions (e.g., themes, life periods, when I was teaching at X university), and self-aspects (e.g., I am a professor). The self-memory system is for certain parts constructed hierarchically with episodic memories at its bottom and more abstract self-aspects (e.g., identities, values, worldviews) at the upper level (Conway, 2009). Thus, episodic memories are some of the ingredients of autobiographical memories, providing the visual imagery and sensory components.

C13P8

Within that memory system, episodic memories can also be understood in terms of prediction error (Haque et al., 2020; Philippe, 2021). They will be encoded in long-term memory only if they provide some information about prediction error. Prediction error takes place when an event occurred and there was something surprising about it that could not be predicted by the person's prior expectations (den Ouden et al., 2012). For instance, an event that was supposed to lead to relatedness satisfaction ends up with a rejection. Prediction error can also occur for positive events. An event that initially appeared ordinary, but which brings a feeling of competence will generate a prediction error. In consequences, most mundane events are quickly forgotten or rendered inaccessible, because they are easily predictable and do not add new information about the self or the world (Brown, 2016). For instance, you probably do not remember all the sensory details of brushing your teeth five days ago, unless something unusual occurred (e.g., you broke a tooth). However, events that are not predicted by priors are more likely to be preserved as episodic memories and then seek integration within the more abstract

representations of the self. Once integrated or that enough information has been gathered to form aggregates of events or semantic knowledge, episodic information is slowly lost (Conway & Pleydell-Pearce, 2000). Thus, episodic memories are information in progress of integration (Philippe, 2021), but they have not yet settled as complex autobiographical memories, semantic knowledge, or self-aspects. As such they represent information about the person, but not yet about the self or only partial information. One important empirical consequence for this is that measures related to episodic memories will not be redundant with self-conceptual measures that assess abstract and general self-aspects or behaviors across multiple occasions (e.g., traits, schemas, general self-perceptions). I will return to this point later.

C13P9      Sensory components of episodic memories are the basic information individuals use to navigate the world and identify whether an event is worthy of encoding in the memory system as a new representation (or as a new prior). Indeed, over and above the perceptual details of an event, the key information is how useful or thwarting the event is to the organism. This strongly defines whether the event is significant for the individual and whether one should strive to reexperience such type of event or should strictly avoid it at all cost.

C13P10      Psychological needs of autonomy, competence, and relatedness are the basic motivational, but also sensory elements orienting humans toward fulfilling situations (Ryan & Deci, 2017). Their satisfaction or frustration triggers a clear response from the striatum, the motivational dopaminergic region of the brain, which encodes which situations should be pursued again in the future or avoided (Reeve & Lee, 2019). Unsurprisingly, need satisfaction has been found to be a core experiential component of memories, one that defines all important and significant memories that are preserved over years. Need satisfaction in memories has also been found to be distinct from other memory characteristics that have been investigated in memory research, including valence, vividness, sharing of the memory, motives (Woike et al., 1999) or redemption and contamination narratives (McAdams et al., 2001). It has also been found to be a strong predictor of well-being, over and above these other memory characteristics, in both cross-sectional (e.g., Philippe et al., 2011, 2015) and longitudinal studies (e.g., Philippe et al., 2012; Houle & Philippe, 2017).

C13P11      It is worth noting at this stage that one important contribution of the concept of need satisfaction to memory and narrative research is that needs clarify what is positive or negative in a past event. Hereby, need satisfaction avoids tautological explanations, such that one found an event to be positive because they experienced positive emotions. Rather, the event was positive and one experienced positive emotions *because* they mastered something important, felt connected to one or more people, or experienced volition in their actions. It also disentangles the valence of an event from the felt experience. Even a negative memory or an event that would be considered negative from a sociocultural perspective can be need satisfying to some extent. For example, in an interpersonal conflict, one



general need satisfaction. As mentioned above, memories represent information in progress of being integrated and they therefore do not overlap with more abstract contextual or trait-level variables in predicting outcomes.

C13P15 Houle and Philippe (2017) showed that need satisfaction in significant memories predicted increased positive mood upon recall. However, need satisfaction in memories that increased the most positive mood upon recall predicted increases in well-being over three months. In other words, memories which boosted mood the most upon deliberate recall were also the ones that could increase well-being over time and this increase was predicted by their level of need satisfaction. Importantly in this study, this effect occurred for both positive and negative memories, highlighting again that need satisfaction is a key experiential component of memories, beyond valence.

C13P16 Need satisfaction as an experiential component of memories has also been shown to predict outcomes in several important life spheres. Because memories related to a domain are more likely to be triggered by features of that domain, domain-related memories should predict domain-related outcomes and not domain-unrelated ones. In one study (Philippe, Koestner, Lecours et al., 2011), participants were randomly assigned to describe either memories related to having been treated unfairly or about having committed an important error (two distinct types of high-arousal negative memories). Two weeks later, all participants watched a film excerpt depicting someone being treated unfairly and then reported on their felt anger. While there was no difference on anger reactivity between the two groups, the level of need frustration for the unfair-treatment memories positively predicted anger reactivity, but not need frustration in the error-related memories.

C13P17 In the relationship domain, Philippe et al. (2013) showed with several studies that need satisfaction in couple-related memories assessed at baseline was associated with relationship quality, but not with friend relationship quality, and predicted increases in relationship quality over two years. Moreover, need satisfaction in couple-related memories at baseline also significantly predicted who remained with their partner and who broke up two years later. These results were obtained after controlling for attachment or need satisfaction in the couple, highlighting again the distinct nature of memories and more general self-perceptual and self-conceptual measures. Need satisfaction in key work-related memories (e.g., a memory of a positive evaluation from the executive committee or a false accusation of psychological harassment by an employee) was also shown in a cross-lagged model to predict increases in self-determined motivation and work satisfaction, and decreases in burnout over two years in college employees (Philippe et al., 2019).

C13P18 Bouizegarene and Philippe (2016, 2018) further demonstrated the contextual nature of memories. They showed in a cross-lagged panel that need satisfaction in friend-related memories of young adults predicted increases in friend satisfaction over two years, as well as increases in friend informational identity style, as opposed to a friend normative identity style. They also showed that need satisfaction in school-related memories was associated with school informational identity style and school satisfaction, but not



with friend informational identity style and friend satisfaction (Bouzigarene & Philippe, 2016). Interestingly, people using an informational identity style can flexibly modify their self-aspects when their personal experiences provide evidence that it should. Conversely, normative identity style implicates a more rigid preservation of self-views, even when facing disconfirming evidence (Berzonsky, 2011). This provides some evidence that experiencing need satisfaction in a life event may facilitate the reinterpretation of internalized policies about the self and the world to build a more coherent identity and self (Soenens & Vansteenkiste, 2011).

C13P19 Thus, a first quality of the integration of a life event is whether the memory of this event was experienced and interpreted as need satisfying or need frustrating. As stated by self-determination theory (Ryan & Deci, 2017), this represents a core ingredient of integration and one that can orient individuals toward either openness and well-being or defenses and ill-being. When encoded in memories, it can be used to predict what to expect and what orientation to choose when facing future similar events.

#### C13S4 **On the Organization of Memories**

C13P20 A memory is never activated alone. Indeed, memories associate with other memories to form *networks of memories* (Brown & Schopflocher, 1998). A network of memories is actually a pattern of activation in the brain that is typically activated whenever a situation triggers a particular memory or that a memory is thought about (McClelland et al., 1986). In such cases, other memories sharing common features with the activated memory, such as a same location, person, emotion, theme, or meaning will be activated as well (Demblon & D'Argembeau, 2016; Philippe et al., 2009).

C13P21 Imagine that Tom has water dripping from a pipe under the sink in his house, and he does not know anything about plumbing. Watching this water drip on his floor, he recalls a memory of a similar event that occurred 15 years ago in his apartment where his roommate had temporarily put a bucket under the sink to catch the dripping water. This also triggers a memory of when he was a child and a water pipe had broken in his parents' garage and his mother was successfully able to repair it. This makes him think of putting a water bucket under the sink and call his mother for help with the water leakage. This simple example illustrates how distinct memories, associated with some related features (water leakage), can optimally orient actions according to the need-satisfying nature of these memories (e.g., relational connection with the roommate and the mother, identification with the roommate's and mother's competence, and autonomy of having control over the problems), despite the negative valence of the event.

C13P22 However, memory networks are not always that optimal. Imagine that Tom is currently eating in a restaurant with his brother. This triggers a memory of the last time he has been eating in this restaurant. That last time, he had broken up with his partner during a diner. Moreover, because the server resembles his former partner, other memories of the breakup period about the partner are also activated. The need-frustrating nature of



these activated networked memories is likely to negatively affect Tom's discussion with his brother at this specific time in the restaurant.

C13P23 The role of these other activated memories part of a network (called *networked memories*) is to facilitate decision making and action in the situation experienced. If the brain only relies on a single memory to make a decision, the probability of being wrong would be too high. By combining information from multiple related memories (akin to using multiple sources of information), the final decision is likely to be better informed and adaptive. Still, the brain probably relies only on a limited number of plausible possibilities, as using too much information would reduce certainty from a probabilistic standpoint (Peters et al., 2017). The need-satisfying or need-frustrating nature of these networked memories is therefore critical.

C13P24 These principles have been corroborated by empirical studies. In these studies, participants are initially asked to think of an important life event that defines them or of a specific past event that was significant (e.g., couple-related memory, memory for an important event that occurred recently like a natural disaster). Next, participants are invited to think of other memories that are related to the main memory they have just described; they are asked to make links with other memories that are somehow related in some ways to their main memory (Philippe et al., 2009). They are instructed to do this task spontaneously and to describe the other memories (i.e., networked memories) that come to mind, even if the link between their memories is not obvious or apparent. In a series of studies, Philippe et al. (2012) showed that the level of need satisfaction characterizing the main memory and the level of need satisfaction characterizing the networked memories were only moderately correlated and each were independently and uniquely associated with well-being. Moreover, need satisfaction in networked memories associated with distinct main memories were only weakly correlated and were also independently associated with well-being, including peers' rated well-being. Need satisfaction in memory networks was also associated with well-being and predicted changes in well-being, even after controlling for traits, general need satisfaction, or psychological symptoms. This further suggests that memory networks are also independent of self-conceptual measures.

C13P25 While both the main memory and its networked memories may each independently contribute to some outcome, networked memories may also mitigate or exacerbate the negative effect of a main need-frustrating memory. In one study (Philippe & Houle, 2020), participants who were directly affected by a recent flooding event were recruited along with participants who only witnessed the flood in their community. All participants were asked to describe a memory about these floods and to think of networked memories. These networked memories, although not directly related to the current floods consisted of priors that were idiosyncratically associated with the floods that the participants had experienced or witnessed. For example, other experienced natural disasters, the death of a close other, or moving to a new house were described as networked memories. Results showed that need satisfaction in these networked memories were a significant predictor

of increases in well-being and decreases in psychological symptoms of depression and anxiety 1.5 month later, even after accounting for the level of need satisfaction/frustration of the main flood-related memory and dispositional emotion regulation styles. Moreover, although those having been affected by the floods reported more psychological symptoms than those who only witnessed them, floods experience did not moderate the results. In other words, being affected by the floods or just witnessing them triggered networked memories that influenced people's well-being and mental health over time as a function of the level of need satisfaction of these activated networked memories.

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The mitigation of networked memories has also been found to moderate the effect of attachment schemas. In two studies (Lejeune et al., 2021), participants engaged in a romantic relationship described couple-related memories and networked memories. Results replicated the classical finding that attachment anxiety and avoidance were negatively associated with couple adjustment (e.g., Roisman et al., 2005). However, results further showed that need satisfaction in networked memories moderated these associations. While most individuals reported a need-satisfying couple-related memory, the networked memories had more variance in terms of need satisfaction and need frustration. Individuals with need-frustrating networked memories had the strongest negative association between attachment anxiety and avoidance and couple adjustment, whereas individuals who reported need-satisfying networked memories had significantly reduced negative associations between their negative attachment schemas and couple adjustment. In other words, the negative effect of anxious and avoidant attachment on couple adjustment was mitigated by relying on couple-related need-satisfying networked memories. This result held even after controlling for need satisfaction experienced within the couple relationship in general.

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Thus, a second quality of integration of a life event is whether its memory, need satisfying or need frustrating, is embedded into a need-satisfying memory network. Need-satisfying memory networks can mitigate the need-frustrating nature of an initial memory or amplify the need-satisfying aspect of a main memory.

C13S5

### **Integration of Memories in Higher-Level Self-Representations**

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The notion of integration in self-determination theory is not only about how past events and their policies are encoded or learned, but also about how these event memories and policies are coherently organized together to facilitate the satisfaction of the psychological needs and avoid conflict among policies. One way to avoid conflicting policies is to build more abstract self-representations to coherently organize lower-level information from episodic and autobiographical memories. A third quality of the integration of life events is thus whether they are integrated or not within higher-order representations of the self.

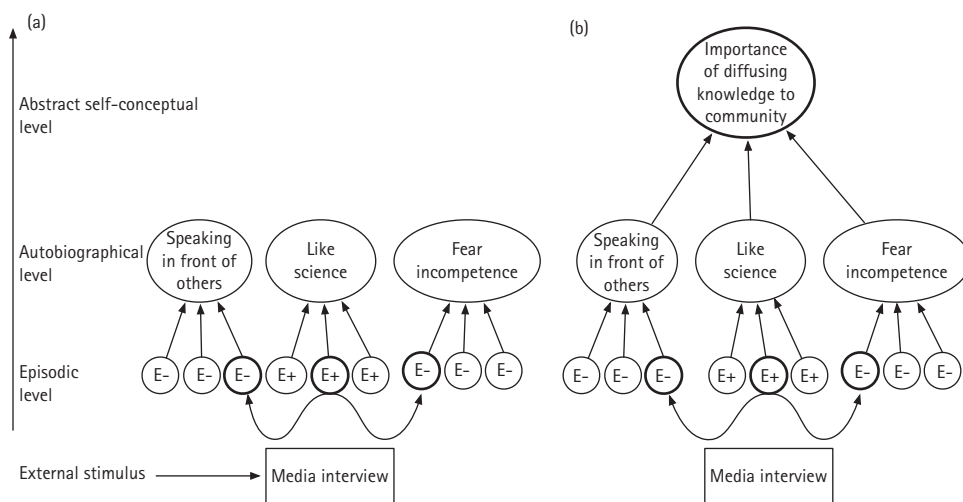
C13P29

As mentioned above, current life events that are not predicted by priors create a prediction error (positive or negative) and the memory system will encode these events as episodic memories with their sensory data. These episodic memories may then create a

new pattern of associations with other episodic and autobiographical memories, forging associative networks (Brown, 2016). From this point, these networks can then be reflected on to build higher-order representations of the self, more abstract in nature, but also more inclusive, often through a process called autobiographical reasoning (Habermas & Bluck, 2000). These more abstract self-representations can represent perceived traits (John et al., 2008), self-aspects (McConnell, 2011), strivings and values (Kasser & Ryan, 1996), or life stories (McAdams & McLean, 2013). It is the coherence among the episodic and autobiographical memories and these more abstract self-representations that facilitates the integrity of the self and its harmonious functioning, and reduces conflicting representations, thereby providing a sense of well-being.

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Abstract representations provide two important qualitative functions to episodic and autobiographical representations. First, they will provide a greater cohesiveness among the activated priors, which will reduce uncertainty (and increase autonomy) about which policy to select. This process is illustrated in Figure 1. When several representations are activated by a given sensory input (e.g., a researcher asked to give a media interview), there is uncertainty about which policy should be chosen. Moreover, these policies may oppose one another, thereby creating conflict (e.g., need-thwarting priors on speaking in front of others, but need-satisfying priors on talking about science, see Figure 1A). However, when these representations are integrated within a higher-level abstract representation (e.g., the value of knowledge diffusion, see Figure 1B), it provides the lower-level representations an overarching organizational structure (Morrissey et al., 2017). Instead of experiencing indecision among three alternative action policies, their combination under some more abstract rule or meaning provides greater coherence and certainty about the selected



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**Figure 13.1.** Schematization of the absence of a higher-level self-conceptual representation (A) and the presence of one (B) as providing a coherence function to lower-levels need-satisfying (+) and need-thwarting (-) episodes and autobiographical knowledge

policy (e.g., I should give the interview to facilitate knowledge diffusion). Moreover, acting in line with these more abstract representations (i.e., herein a core intrinsic value) also provides a greater sense of self-determination (Kasser & Ryan, 1996). This also illustrates why tasks, activities, or norms that are internalized out of external pressure or introjected regulation, for instance, can create priors that are independent and detached from other self-representations. It is indeed difficult to coherently organize under a higher-level abstract representation core to the self some other external or introjected representations as they will likely be conflicting, which should reduce well-being and vitality over time (Ryan & Deci, 2017).

C13P31 The second function of abstract representations over episodic and autobiographical representations is that they can inhibit the activated priors that do not conform to the policies of the more abstract representations, thereby providing greater self-control and less conflicting representations.

C13P32 Higher-level representations are situated in the neocortex, mostly the medial prefrontal cortex (D'Argembeau et al., 2014; Demblon & D'Argembeau, 2017; Eichenbaum, 2017). When a stimulus is perceived in a given context, they send downward inhibitory signals to the hippocampus that explain away its activation (Barron et al., 2020). This predictive coding can then inhibit lower-level representations that are considered inappropriate in the activated context (Jin & Maren, 2015). For example, the fears of speaking in front of others and of incompetence are more likely to be reduced by the action policy of the higher-level representation shown in Figure 1B than in Figure 1A, as these negative feelings should be bypassed and inhibited by the larger personal importance of contributing to diffuse knowledge.

C13P33 If lower-level representations are detached from higher-level representations of the neocortex, these representations are unlikely to be inhibited by downward activation from the neocortex. Consequently, these representations are more likely to trigger their lower-level associated policy and can lead to perceived threat or impulsive actions in inappropriate context. Recently, we investigated these effects applied to sexuality by showing that sexual representations that are not well integrated with other representations, such as relational representations, are associated with a sexuality that is intrusive, experienced as controlling by the person, and which leads to unnuanced judgment in relational contexts and negative relational consequences (Philippe et al., 2017).

C13P34 Similarly, certain episodic memories may not be amenable to such an integration and may remain unassociated or incoherently integrated with other more abstract self-representations. When episodic memories are not well integrated into higher-level representations, two consequences are in order. First, the brain will often try to achieve integration by replaying the episodic memories, which can lead to intrusive thoughts, flashbacks, and re-enacting of the event in other situations (Brewin, 2014). Second, these episodic memories will then be more likely to get activated by external cues because the neocortex cannot provide downward inhibitory activation of these representations

in contexts where activation of the episodic memory would be deemed inadequate or maladaptive.

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Here is an illustration of this process. Imagine that Tom is a full-time runner, and he has trained hard to run a marathon. On the day of the run, he feels great and has a lot of energy. But during the marathon, he starts to feel unwell, and his finish is more than five minutes above the time he expected to do. Tom feels ashamed and incompetent and feels that he has disappointed his coach (see Lopes & Philippe, 2022). This event will be encoded in Tom's memory system because it is at odds with what was predicted by Tom (e.g., his policies about training) and his basic psychological needs (therefore triggering a prediction error). Failure at running therefore becomes a threat and produces a dose of uncertainty about his self-efficacy at running. If this memory is not positively integrated, it runs the risk of being reactivated during training and other races and could negatively affect Tom's well-being and performance. However, if Tom is able to reflect on this event, understands the mistakes he might have made in his preparation, and recognizes the felt pressure he is experiencing due to his introjected belief that his coach has to be proud of him, he will be able to integrate this event into more abstract self-representations (Tom as a runner; Tom preparing himself for a run; Tom who should be careful not to try to achieve others' standards). This is likely to forge novel policies aimed at improving Tom's next marathon performance (reduce uncertainty) and produce emergent abstract properties (e.g., it is important to absorb more carbohydrates before the marathon; I have the right to only focus on what makes me proud and not feel controlled by others' expectations of me).

C13P36

This example illustrates how emotion regulation plays a big part in the process of integration (Weinstein et al., 2013). In that sense, the emotion regulation style used to face a particular life event will often be decisive in whether this event will be integrated or not and the consequences this event will have in the person's life afterward, independently of its level of need satisfaction. It also highlights how a need-frustrating event can lead to either decrease well-being and symptoms or engender more personal resources and resilience.

C13S6

### **Emotion Regulation as an Integrative Action Policy**

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Recently, self-determination theory has developed a model of emotion regulation that is helpful to understand how the style of emotion regulation chosen can have important consequences for the integration of life events as memories. This model consists of three emotion regulation styles.

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Integrative regulation is characterized by openness, interest, and tolerance toward one's emotions, even if they are threatening, and as having a capacity to reflect on them and use the emotional information to forge better policies of action and meaning (Roth et al., 2014; Ryan et al., 2006). Controlling regulation is characterized by a rigid intolerance toward negative emotions and a strong urge to hide, ignore, and suppress their experience or expression (Roth et al., 2014, 2018, 2019). Finally, amotivated regulation

or dysregulation corresponds to a lack of capacity to adequately and effectively regulate one's negative emotions, which results in an emotional overflow and a sense of being overwhelmed by emotions. These three emotional regulation styles are also in line with recent theoretical models (e.g., Nolen-Hoeksema, 2012) and meta-analyses of emotion regulation strategies (e.g., Naragon-Gainey et al., 2017), which highlighted that most existing measures of emotion regulation and coping strategies fall into three similar styles.

C13P39

An extension of the emotion regulation model of self-determination theory is to look at how a life event has been regulated in the past. In addition to the sensory components of the event, the emotion regulation strategy used to process the event is encoded with the memory of the event. Thus, the emotion regulation style used will leave an encoded trace in memory and we can understand this trace as an action policy, indicating how a similar event should be emotionally processed in the future (or how to act on a similar event). Whenever the memory is reactivated, the same action policy will be evoked as the best action to undertake when facing a similar situation.

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Imagine that Tom's mother had a car accident two years ago. She was lucky and was not injured, but the car was a total loss. Seeing his mother's wrecked car, Tom experienced a great fear, but he tried to conceal this fear to his mother and made great effort to stop thinking about this mental image of the heavily damaged vehicle that kept popping in his mind. Since that event, unbeknownst to him, Tom has slowly started to feel more and more anxious and stressed when driving. Since Tom used controlled regulation to suppress his fear relative to his mother's accident, this type of regulation became an action policy for Tom whenever a car is involved. Therefore, Tom has also tried to reduce his stress while driving by ignoring his feelings and by dissociating himself from them. This strategy has worked for a while until one day, Tom was unable to get in his car because he was panicking and was afraid something terrible might happen, but he had no clue why he was feeling this way.

C13P41

This example illustrates two things. First, using an emotion regulation style with respect to an event makes it more likely to use the same regulation style again when a similar event or one that will reevoke it will take place. Because Tom initially used a controlled regulation to deal with his mother's car accident event, he was more likely to use the same regulation style when his mother's accident memory was reactivated by the external stimulus of a car. If Tom had rather taken interest in his stress and tried to understand why he was experiencing it while driving—an integrative regulation—he might have been able to realize that driving is reminiscent of his mother's accident and that at the time of the accident, he avoided processing his fear of losing his mother. This would then help connect the two events into a more abstract representation and a meaning policy might emerge from this connection (e.g., it is important to cherish those I love, because life can be fragile). Similarly, experiencing a new event that reactivates memories with an encoded integrative regulation policy will increase the likelihood that the person will again use integrative regulation to process the novel event (see Houle & Philippe, 2020).

C13P42

Second, controlled and amotivated emotion regulation as action policies are unlikely to facilitate event and memory integration, as they only serve to temporarily reduce sensory input (i.e., ignore or expel the emotion). Need thwarting events usually signal that an action or meaning policy may need to be changed or that something needs to be done differently in the future. Therefore, continuous avoidance or amotivated regulation prevent changes to the priors and to their policies and hinder the construction of higher-level representations. Thus, Tom's mother car accident would remain as an unintegrated episodic memory, which would be likely to resurface through rumination, intrusive thoughts, and flashbacks. Only an integrative regulation is likely to achieve event integration by remaining aware and nondefensive of the felt sensory input (Weinstein et al., 2013). This would then facilitate the coherent integration of memories in more abstract representations of the self. Thus, whether an event is approached with avoidance, amotivated, or integrative regulation has important consequences for the action policy that will be encoded with that memory and for the capacity of integration of that memory and of future life events.

C13P43

Recent empirical research has examined those claims (Philippe et al., 2021). A measure of emotion regulation in memories was initially developed based on the emotion regulation scale (Roth et al., 2009, 2014). To examine the encoded emotion regulation style used in a past event, participants were assessed on the emotion regulation style they used while thinking of a significant negative past event. The measure assessed controlled regulation (e.g., I try to avoid thinking back to this event), amotivated regulation (e.g., I still feel an overflow of emotion), and integrative regulation (e.g., I realize that this event helped me learn new things about myself). Then participants were asked to recall networked memories, that is, other memories associated with the main memory they had just described, and rate each memory for emotion regulation. The results showed that similar to need satisfaction, memories regulated by one style of emotion regulation were more likely to associate with other networked memories characterized by the same style of regulation. Moreover, this clustering was not due to individual differences in emotion regulation in general, as assessed with the emotion regulation scale for negative emotions in general and was independent of the level of need satisfaction assessed in the memories (see also van der Kaap-Deeder et al., 2016).

C13P44

In two subsequent studies (Philippe, Geoffroy et al., 2022), we examined the effect of traumatic events on the development of posttraumatic stress disorder (PTSD) symptoms. A sample of participants whose houses were flooded during a natural flooding disaster and a second community sample of adults recruited during the COVID-19 pandemic described a central event related to the floods or the pandemic, respectively, and described networked memories related to this central event. They were also assessed for their emotion regulation of each described event memory. Results showed that the way the main event memory (flood or pandemic) was emotionally regulated and the emotion regulation characterizing networked memories associated with these main memories were associated with PTSD symptoms and predicted increases in symptoms over six months. More



specifically, memories characterized with controlled or amotivated regulation predicted increased PTSD symptoms over time, whereas memories of integrative regulation were unrelated to PTSD symptoms.

C13P45

Controlled and amotivated regulation encoded in memories as policies will only seek to reduce the sensory input upon similar events reactivation. Doing so, they reduce the likelihood that the episodic memory of an event regulated with these styles will be integrated into high-level representations that could potentially change the policy of this event. As such, past events regulated with controlled or amotivated regulation are more likely to constantly trigger the same controlled and amotivated regulation over time, which if chronically activated, are likely to disrupt functioning and induce the avoidance and arousal characteristic of PTSD symptoms.

C13P46

Conversely, when integrative regulation is used, the priors (i.e., networked memories and their policies) are changed. First, since integrative regulation facilitates the openness toward one's subjective experience, the sensory input is richer, and a greater number of associations can be made with priors. As a consequence, more profound and complex associations can be made, and a deeper meaning from the lived experience can emerge. It is with integrative regulation that one may find profound self-understanding (e.g., I am a strong person), thereby allowing for emergent properties, novel representations, and more coherent organizational structures. These more complex self-structures associated with a specific sensory input can later be used to reduce the perceived threat of this sensory input (through top-down inhibitory pathways), develop more adaptive and precise actions (policies), which can provide again greater inhibitory control, affect tolerance, or delay of gratification. This ultimately builds what is often called resilience. Such an integrative processing with respect to difficult or traumatic experiences, however, is more likely to occur within a need supportive therapeutic encounter.

C13S7

## Summary and Conclusion

C13P47

In this chapter, I described three qualities that facilitate the integration of significant life events in what self-determination theory has called the self. I used a memory approach to highlight how the concept of integration of self-determination, originating from an organismic perspective, conforms to other neurocognitive theories on memory and the brain. Obviously, more research is needed to better understand the role of emotion regulation as action policy of memories and how to facilitate the positive integration of difficult and traumatic memories in higher-level representations. These future research avenues appear as fruitful paths to pursue to develop clinical interventions as well. Given the space constraint, I did not cover the important role of the social environment and of other people in the interpretation of life events as need satisfying, but also in transforming memories (e.g., Chua et al., 2021), and in facilitating integrative emotion regulation (Roth et al., 2009) and the integration of events in higher-level representations. These are important areas that also need to be expanded by future investigations.

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